RAY–BY–RAY FOURIER IMAGE RECONSTRUCTION FROM PROJECTIONS

Abstract

Two-dimensional or three-dimensional images of the distribution of a property of an object are formed by passing beams, or rays, of energy through the object and detecting how much each ray is attenuated by the property. The Fourier transform is taken of each individual ray but only the zeroth component of the transform along the path of the ray is retained. Each of these components is added into a two or thee-dimensional array. If the distribution of a two-dimensional slice of the object is being imaged, the component is a line of numbers, which is added into the two-dimensional array at right angles to the path of the ray. If the distribution of a three-dimensional object is being imaged, the component is a plane of numbers, which is added into the three-dimensional array at right angles to the path of the ray. The numbers in the array are multiplied by a ramp function to correct for the non-uniform density of data. After enough such rays in enough different locations pass through the object and are processed, the distribution of the property of the object is obtained

by taking the inverse Fourier transform of the data in the array.